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The Use of Numerical Methods and Differential Algebra in Magnetic Field Computation.* S. Caspi, M. Helm, L.J. Laslett, W.M. Fawley, Lawrence Berkeley Laboratory, and M. Berz, Michigan State University — In the region interior to coil windings of accelerator magnets the three spatial components of magnetic field can be expressed in terms of "harmonic components" proportional to functions $\sin(n\theta)$ or $\cos(n\theta)$ of the azimuthal angle. The r, z dependence of any such component can then be expressed in terms of powers of r times functions $A_n(z)$ and their derivatives. For two-dimensional configurations, the harmonic components of the transverse field then acquire a simple proportionality $B_{r,n} \propto r^{n-1} \sin(n\theta)$, $B_{\theta,n} \propto r^{n-1} \cos(n\theta)$, whereas in a 3-D configuration the more complex nature of the field gives rise to additional "pseudo-multipoles". Computation of the 3-D magnetic field arising as a direct result of a specified current configuration, can be calculated explicitly through use of the Biot-Savart law and from such data the coefficients $A_n(z)$ can then be derived. We indicate, discuss, and illustrate two means by which this development may be performed, employing in the second of these methods computations based on the use of Differential Algebra.

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